

Nov. 18, 1969

H. M. BAUSERMAN

3,478,679

PULP DELIQUIFYING PRESS

Filed May 24, 1967

2 Sheets-Sheet 1

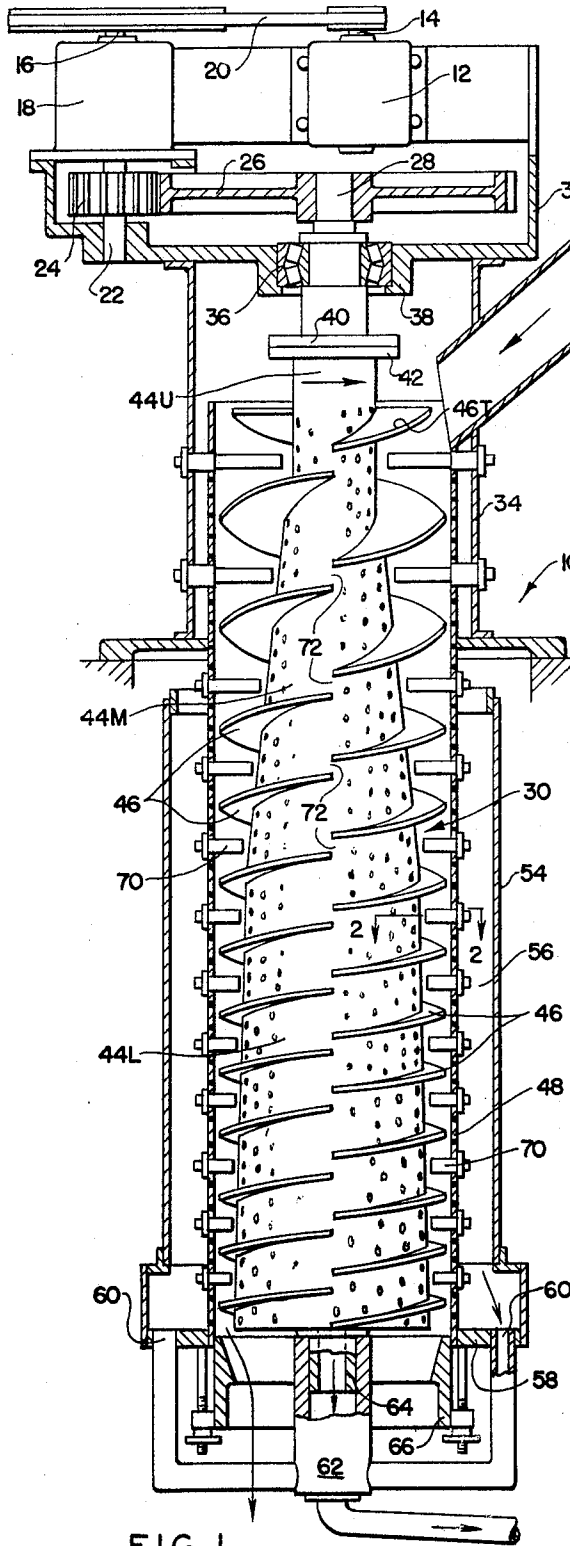


FIG. 1.

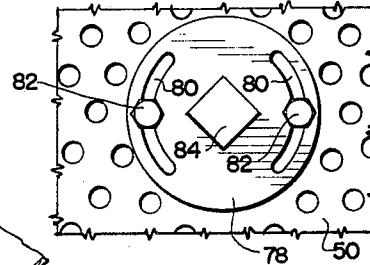


FIG. 3.

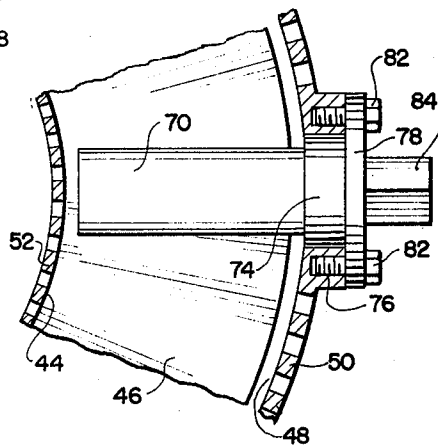


FIG. 2.

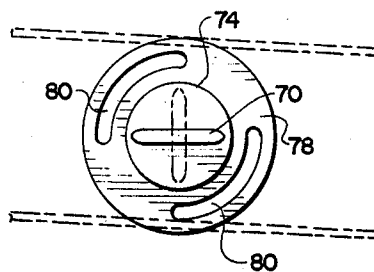


FIG. 4.

INVENTOR.
HOWARD M. BAUSERMAN

BY

Anderson, Fung & Wymore

ATTORNEYS

Nov. 18, 1969

H. M. BAUSERMAN
PULP DELIQUIFYING PRESS

3,478,679

Filed May 24, 1967

2 Sheets-Sheet 2

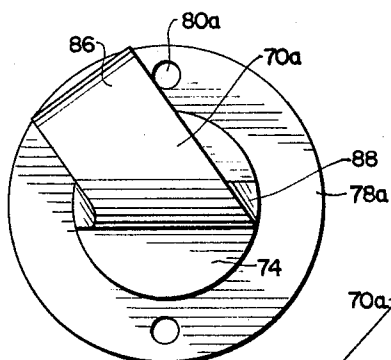


FIG. 6.

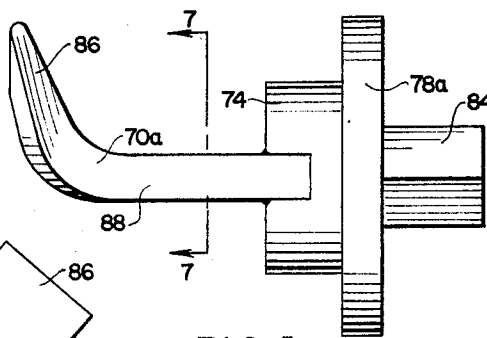


FIG. 5.

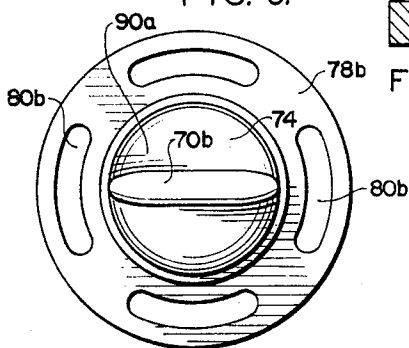


FIG. 9.

FIG. 7.

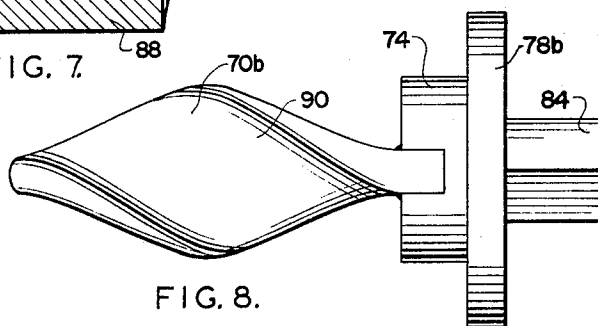


FIG. 8.

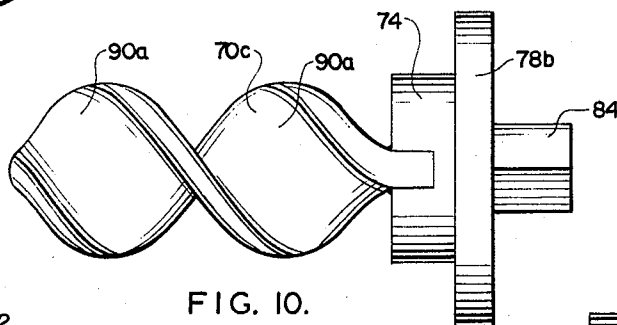


FIG. 10.

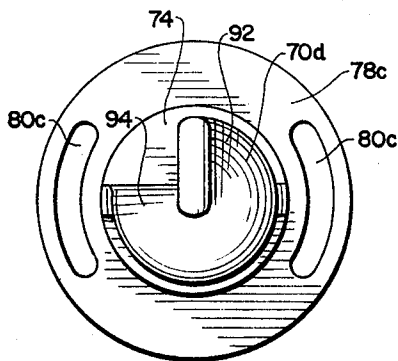


FIG. 12.

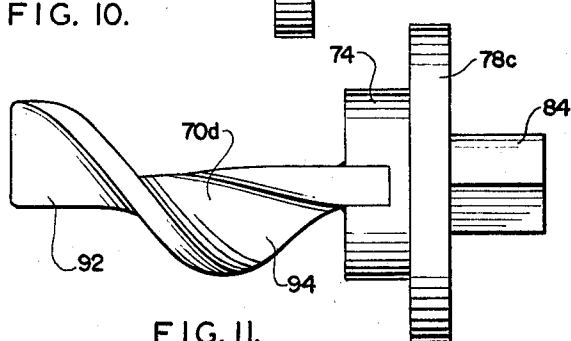


FIG. 11.

INVENTOR.
HOWARD M. BAUSERMAN

BY
Anderson, Thompson & Moore

ATTORNEYS

1

2

3,478,679

PULP DELIQUIFYING PRESS

Howard M. Bauserman, Littleton, Colo., assignor to Stearns-Roger Corporation, Denver, Colo., a corporation of Colorado

Filed May 24, 1967, Ser. No. 640,917

Int. Cl. B30b 9/12

U.S. Cl. 100—117

10 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to an improved rotating screw-type pulp press wherein adjustable bladed stops are interposed in the path of the rotating compressed pulp mass between interruptions in the helicoid flighting on the tapered spindle for the purpose of varying the pulp flow-rate along with its fluid content and also mixing same so as to bring the wet portions thereof farthest from the screens into closer proximity thereto.

Screw-type pulp presses are well-known in the art and they are widely used for reducing the liquid content of pulpy masses such as sugar beet pulp and the like. Generally speaking, these units have a tapered spindle mounted for rotation about a vertical axis with the small end at the top and the large end at the bottom. The body of the spindle comprises a hollow perforated shell into which the liquid residues may pass. This perforated shell is equipped with interrupted segments of helicoid flighting that spiral down the outside tapered spindle surface. These flights extend outward radially beyond the axis of rotation substantially the same distance which means, of course, that they are considerably larger near the small end of the spindle than at the bottom where the latter element has a larger diameter. In addition, these flights are closer together at the bottom than at the top so that as the pulp migrates downwardly under the influence of the screw-action of the rotating spindle, it is compressed tighter and tighter between adjacent flights and also radially between the tapered shell of the spindle and the outer cylindrical screen that envelops the latter.

In the better-designed screw-type presses, the flight segments are staggered or offset longitudinally to leave a gap therebetween through which stationary stops fastened to the outside fixed screen can pass as the spindle rotates. In the ordinary screw-type pulp press, these stops perform a single function, namely, to prevent the pulp mass from turning in unison with the rotating spindle thus causing it to respond to the screw-action of the helicoidal flight sections and migrate toward the discharge end of the unit.

Studies on this type of press indicated that the rate of flow of water or other fluid out of the pulp mass was dependent upon the pressure developed, the consistency of the pulp and the distance the water must travel out of the mass. It was found, for example, that relatively low pressures were advantageous in that they avoided compressing the pulp mass to the degree where the interstices between the pulp particles through which the fluid had to pass in order to escape were cut off. Tests seemed to indicate that most of the extracted fluids came from areas of the pulp mass near the exposed surface; whereas, a good deal of the fluid in the interior reaches of the mass became trapped therein as the mass was more and more highly compressed so that it became nearly impossible to extricate by this method.

Predicated upon these tests, it has now been determined in accordance with the teaching of the instant invention that the efficiency of the screw-type pulp press in terms of percentage of fluid removed can be materially enhanced through the use of a novel and improved de-

flector-type adjustable stop in place of the fixed stop now used. For example, by mounting a simple flat-bladed stop such that it can be adjusted angularly about its longitudinal axis, it becomes possible to vary the thru-put of the press which has the effect of altering the amount of fluid expressed from the pulp. Such a blade adjusted to deflect the pulp back up against the helicoid flight immediately above it substantially reduces the flow-rate of the pulp through the unit and, at the same time, increases the internal pressures developed within the pulp mass so that a drier product results. Conversely, by inclining the flat-bladed stop so as to deflect the pulp downwardly causes an increase in the thru-put and a lessening of the internal pressure to produce a wetter product. Thus, with simple flat-bladed stops mounted for adjustment about their longitudinal axes, the press can accommodate pulps of varying consistencies and, for each particular pulp, be adjusted to produce a product having varying degrees of dryness.

As previously mentioned, however, that is yet another problem to be reckoned with which is not solved by the simple adjustable flat-blade stop, namely, that of getting the wet material in the interior of the pulp mass closer to the perforated screens so that the fluids entrained in the pulp have a shorter distance to travel before escaping through either the spindle screen or fixed screen. The latter problem is solved in accordance with the present invention by curving the blade of the stop in such a manner that the pulp impinging thereagainst is turned over and otherwise mixed so that the interior wet portions are moved out toward or onto the exterior surfaces of the mass where the fluids are more readily squeezed therefrom. These curved plow-like blades will perform the mixing function even though fixedly mounted; therefore, by using them in combination with a set of flat adjustably-mounted blades, both the flow-control and mixing functions can be accomplished in the same unit. On the other hand, certain of the curved-blade configurations can, if adjustably mounted for rotation about their longitudinal axes, perform both the mixing and flow-regulating functions provided their design is such that upon limited rotation, the flow of the pulp mass can be impeded or accelerated due to the deflection caused thereby.

It is, therefore, the principal object of the present invention to provide a novel and improved screw-type pulp deliquifying press having stops of unique design and function.

A second objective of the invention herein disclosed and claimed is the provision of means within a pulp deliquifying press for varying the liquid content of the product issuing therefrom.

Another object is to provide means in the pulp cavity of a screw-type press adapted to mix the pulp mass as it progresses therethrough and remove a higher percentage of the liquid components contained therein.

Still another objective of the invention herein disclosed and claimed is to provide deflector-type blades in a pulp press that are mounted for limited rotational adjustment about their longitudinal axes to regulate the flow of a particular material or accommodate materials of varying characteristics.

An additional object of the invention is the provision of plow-shaped deflectors placed in the path of the pulp moving through a pulp press that are curved to produce surfaces capable of interchanging the drier pulp near the outer area for the pulp with fluid still trapped therein in the interior of the mass.

Further objects of the invention are to provide an improved screw-type pulp press that is more efficient in terms of fluid removal, one that is readily adaptable to different types of materials as well as to vary the con-

sistency of the output from the same feed, and an improvement that can be incorporated into existing machines without substantial modification.

Other objects will be in part apparent and in part pointed out specifically hereinafter in connection with the description of the drawings that follows, and in which:

FIGURE 1 is a partial vertical diametrical section showing a conventional tapered spindle screw-type pulp press modified to include the adjustable deflecting stops of the instant invention;

FIGURE 2 is a fragmentary section taken along line 2—2 of FIGURE 1 showing one of the stops to a considerably enlarged scale;

FIGURE 3 is an axial view of the stop subassembly of FIGURE 2 as seen from the outside of the press;

FIGURE 4 is an axial view of the same stop as seen from inside the unit but with the outer screen removed and the adjacent helicoid fighting sections indicated in dotted lines;

FIGURE 5 is a side elevation showing a modified form of the stop curved to perform the mixing function in addition to the flow-control function;

FIGURE 6 is an interior end view of the stop of FIGURE 5;

FIGURE 7 is a section taken along line 7—7 of FIGURE 5;

FIGURE 8 is a side elevation similar to FIGURE 5 showing a third form of the stop having a 180° axial twist therein;

FIGURE 9 is an interior end view of the stop of FIGURE 8;

FIGURE 10 is a side elevation of another form of curved stop much like the stop of FIGURE 8 except having a 360° axial twist;

FIGURE 11 is a side elevation showing still a further modified form of the stop having a 270° twist; and

FIGURE 12 is an interior end view of the FIGURE 11 stop.

Referring now to the drawings for a detailed description of the present invention and, initially, to FIGURE 1 for this purpose, reference numeral 10 has been employed to designate the pulp press in its entirety and it will be seen to include a drive motor 12, the output shaft 14 of which is connected in driving relation to the input shaft 16 of gear reducer 18 by means of belt and pulley drive 20. The output shaft 22 of the reducer 18 carries gear 24 that is connected in driving relation to gear 26 mounted atop the spindle 28 of tapered helicoid screw assembly 30. The foregoing elements are mounted within or otherwise attached to a gear box 32 that is, in turn, fastened atop a cylindrical housing 34.

Screw assembly drive spindle 28 is journaled within a bearing 36 that is carried by an annular boss 38 formed in the bottom of the gear box. The flanged lower end 40 of the drive spindle is connected to a similar flange 42 atop the hollow tapered screen 44 that forms a part of the screw assembly 30. This last-mentioned screen has the helicoid fighting sections 46 attached to its outer surface in an arrangement that will be described in detail presently.

Surrounding the entire screw assembly is an outer cylindrical screen 48 that, along with the tapered inner screen, can best be seen in FIGURE 2. As illustrated in FIGURE 2, both the inner and outer screens comprise two or more screen elements sandwiched together to form a laminate with the elements (44 and 48) having the smallest holes lying adjacent one another while those elements (50 and 52) with larger holes occupy remote relative positions and functioning to hook-up and strengthen the smaller screens.

Again with reference to FIGURE 1, it will be noted that the outer cylindrical screen is, in turn, enveloped by a solid cylindrical member 54 that lies in spaced relation thereto and defines a continuous annular passage 56 for the flow of liquid emerging from said outer screen. The

lower ends of the outer screen 48 and cylindrical member 54 are joined to one another by ring 58 that cooperates therewith to produce a fluid reservoir having drains 60 in the bottom thereof that connect into a common sump 62 into which the fluids flowing inwardly through the tapered inner screen 44 also emerge. The stub drain pipe 64 in the bottom of the tapered screen discharges the fluids from the latter into the sump 62 and, in addition, functions as the stub shaft on the lower end while said sump operates at its journal. Thus, the fluids squeezed from the wet pulp can either emerge from the press by passing out through the outer cylindrical screen or flow inwardly through the tapered screen while the deliquified pulp is forced down between the latter screens by the helicoid flights on the rotating screw assembly. As the pulp leaves the bottom of the screw assembly, it drops out of the press and passes through fluted ring 66 fastened to the underside thereof in encircling relation to the sump 62.

The wet pulp is introduced into the top of the screw assembly through intake chute 68 mounted within an opening in cylindrical chamber 34 beneath the gear box 32. As the pulp drops into the press, it is immediately picked up by the uppermost section of interrupted helicoid fighting 46T which, due to its inclination and the rotation of the tapered screen assembly, begins to force it downwardly.

Now, in the particular form illustrated, the inner screen will be seen to include an upper substantially cylindrical section 44U near the top and extending down about to the level of the second section of fighting, a middle conical section 44M having a rather pronounced taper, and a lower conical section 44L that is still tapered but less radically than the middle section.

With the exception of the uppermost section of helicoid fighting 46T which may terminate a good deal inside the adjacent surface of fixed cylindrical screen 48 in order to admit the incoming wet pulp, all of the other fighting sections have peripheral margins terminating in closely-spaced relation to the outer screen. Thus, due to the taper of the inner screen 44 to which they are attached, the maximum radial dimension of each fighting section becomes progressively smaller from top to bottom. These flights are also progressively closer together from top to bottom while, at the same time, their pitch becomes less pronounced. Ordinarily, these flights would be expected to cooperate with the screens to define a pulp-flow path through the press of steadily decreasing volume that would function to compress the pulp and squeeze the fluids therefrom; however, it was found that instead of the pulp moving along in this fashion, it tended to turn along with the inner screen and not move from flight to flight. Accordingly, stops 70 were attached to the outer screen facing radially inward between each section of fighting for the purpose of engaging the wet pulp and preventing it from turning with the inner screen so it would progress on down the screw due to the retardant action of said stops. Thus, in order for the stops 70 to work between the sections of helical fighting, it was necessary to interrupt the fighting at each stop as indicated at numeral 72.

Now, as previously mentioned, the simple bar stops used in the prior art pulp presses performed the retarding function so necessary to keep the pulp moving along the screw, but they were incapable of bringing about any variation in flow-rates, nor did they mix the pulp so as to bring the wetter portions out to the screens. With particular reference to FIGURES 2, 3 and 4, it will be seen that the stops 70 in the instant pulp press have been redesigned and remounted to accomplish the aforesaid additional functions. Specifically, as seen most clearly in FIGURE 4, the stop 70 is in the form of a blade that projects radially into the gaps 72 left between the fighting sections. This blade is fastened to a short cylindrical support 74 that is mounted for rotational movement within an integrally-formed annular boss 76 (FIGURE 2) provided for this purpose in the outer screen 50. Mounted atop this cylin-

5

dricul support and fastened thereto is a disk 78 having a pair of diametrically-positioned circumferential slots 80 along its outer margin. This plate rides atop the boss and bolts 82 passing through the slots fasten the assembly to the outer screen for limited rotational movement between the full-line position of FIGURE 4 wherein the blade offers the least resistance to the flow of the pulp and the dotted line position where it provides maximum resistance. A head 84 projects from the plate and is shaped to receive a wrench or similar tool for changing the blade inclination.

With the blades occupying the full-line position of FIGURE 4, they offer relatively greater resistance to the downward passage of the pulp which remains in one place thus resulting in a decrease in the flow-rate. Conversely, turning the blades into the dotted line position of FIGURE 4 where they offer maximum resistance to rotation of the pulp brings about an increase in the flow-rate for the reason that the pulp is held back against the helicoid fighting and forced to migrate downward along the screw. Obviously, between the maximum and minimum resistance positions lie a substantially infinite number of others that can be employed to provide flow-rates that can be selected to suit a wide variety of different products as well as variations in the same product. Of course, the faster the pulp moves through the press, the less liquid removed therefrom and vice versa.

Thus, by means of the simple, but unobvious, expedient of providing the conventional screw-type pulp press with rotatably-adjustable bladed stops, the user can control flow-rate and thus the degree of wetness of the product emerging therefrom through relatively wide limits.

Next, with reference to FIGURES 5-7, inclusive, a first modified form of stop subassembly has been illustrated that employs a plow-type blade 70a rather than the straight blade 70 of FIGURES 1-4. Blade 70a is essentially L-shaped in the particular form illustrated, the inner extremity being bent to produce a laterally-extending foot 86 that is both angled away from the direction of pulp-flow and also tilted toward the pulp moving thereagainst so as to scrape it off the tapered inner screen and move it outwardly therefrom with a plowing and turning action. The primary function to be performed by these plow-shaped stops 70a is that of mixing the pulp mass by taking the dry layer adjacent the inner screen and interchanging it with some of the wetter pulp in the interior regions of the pulp blanket. While the radially-extending blade portion 88 that lies intermediate the foot 86 and the cylindrical connector 74 functions to retard movement of the pulp mass in much the same way as blade 70 in the full-line position of FIGURE 4, this is not the primary function of the plow-shaped stops. While it is apparent that rotation of stop 70a will enable the bladed shank 88 thereof to perform much the same flow-control function achieved by straight blade 70 of FIGURE 4, a corresponding loss in efficiency of its mixing function will inevitably result as the laterally-extending foot is turned away from the direction of pulp-flow; therefore, the plow-shaped stop 70a is preferably mounted in fixed position and used in combination with one of the forms of flow-control blades so that both the mixing and flow-control functions can be performed most efficiently. For this reason, disk 78a has been modified slightly to eliminate the elongate circumferential or arcuate slots 80 in favor of ordinary round bolt holes 80a. The remaining elements of the stop subassembly remain unchanged although the tool-receiving head 84 may be eliminated when modified disk 78a is employed because there is no provision made in said plate for turning the stop about its longitudinal axis.

FIGURES 8 and 9 to which reference will now be made show another modification of the stop 70b which is characterized by twisting a flat blade, like at 70 in FIGURE 4, through an angle of 180° about its longi-

6

tudinal axis. Such a blade configuration combines the flow-rate regulating function of blade 70 with the mixing function of plow-like blade 70a while, at the same time, preserving the unregulated pulp-retarding function of the conventional fixed stops.

Half-twist blade 70b must be mounted for limited rotational adjustment in order to provide for regulation of the flow-rate. In the particular form illustrated, disk 78b contains four arcuate slots 80b instead of two with each slot extending angularly about 45°. Thus, a maximum of one-eighth turn of the blade relative to the flow of the pulp is possible using a given diametrically-opposed pair of slots; however, using the remaining pair shafts the blade 90° while providing the same 45° adjustment. When using one pair of slots, the thin edge of the blade is presented to the pulp impinging thereagainst at both ends while the broad face engages the middle thereof assuming, of course, that the bolts are located at the midpoint of the slots. Conversely, with the bolts similarly positioned in the other pair of slots, the thin edge of the blade is presented to the pulp at its midpoint while the extremities of the blade contact it with the broad faces.

Perhaps the simplest way to describe the action of half-twist blade 70b is in terms of its overall effect. When blade 70b is positioned between the flights such that the trough 90 in the face thereof against which the wet pulp impinges is facing downwardly and outwardly as seen in FIGURE 8, the layer of pulp nearest the rotating screen will be lifted away and turned down and out toward the stationary screen thus increasing the flow-rate while simultaneously accomplishing the mixing function. If, on the other hand, the blade is positioned such that trough 90 extends upwardly and inwardly, the pulp will be picked up off of the fixed screen, mixed and moved up toward the rotating screen causing a reduction in the flow-rate and a correspondingly drier product. Between these extremes are many degrees of different flow-rates all accompanied by some mixing of the pulp so as to bring the wetter portions out onto the surface where additional fluid can be extracted therefrom. Thus, while blade 70b can be used with disk 78 of FIGURE 4 that permits a full 90° turn, plate 78b of FIGURE 9 is generally adequate as it permits the trough 90 to be inclined upward or downward approximately 22° relative to the pulp flowing thereagainst.

In FIGURE 10 will be seen a further modified form of the bladed stop 70c wherein the blade is provided with a full 360° twist instead of a 180° one. The same disk 78b is used therewith as well as the same cylindrical mount 74 and tool-receiving head 84. The action is quite analogous to the half-twist version 70b except two narrower troughs 90a tend to divide the pulp mass passing thereover into two separate ribbons and thus bring about more complete mixing. The flow-rate control is, once again, brought about by deflecting the pulp mass either upwardly against the overhead fighting section or downwardly against the flight immediately therebeneath.

Finally, with reference to FIGURES 11 and 12, still another version of the stop subassembly has been shown wherein a half-width blade containing a three-quarter twist 70d has replaced the blades of the previously-described embodiments. Because blade 70d is only half as wide as blades 70, 70b and 70c, it offers less resistance to the flow of pulp but, nevertheless, accomplishes both the mixing and flow-control functions. The main difference in the action of blade 70d is that the troughed surfaces 92 and 94 over which the pulp mass passes are not essentially parallel with one another as was the case with the troughs 90a in the FIGURE 10 version. Thus, as the pulp passes across troughed surface 94, it will be deflected at a different angle than the pulp impinging upon surface 92. The ribbons of pulp thus separated from the mass thereof impinging against blade 70d will move away therefrom in slightly different directions and become more thoroughly mixed for this reason. Of course, by

turning these surfaces up or down, the flow-rate control function is accomplished in the same manner as with the previous embodiments.

Yet another version of disk 78c has been shown with blade 70d wherein the arcuate slots 80c are much like slots 80 in the FIGURE 4 version except they extend only about 60° angularly rather than 90°. Due to the narrower width of blade 70d when compared with blades 70b and 70c which are analogous in thier action, somewhat greater angular adjustment is preferred in order to cover about the same range of flow-rate control.

In closing, a few other points are worthy of specific mention. Any of the blade designs 70, 70a, 70b, 70c and 70d can be used with any of the adjustable disks 78, 78b, or 78c and produce entirely satisfactory stops capable of bringing about rather precise flow control. All of the blades including flat blade 70 will bring about some degree of mixing although blades 70a through 70d are preferred in terms of this function due to their improved plow action. In installations where flow-rate control is of minor importance compared with the mixing function, L-shaped blade 70a is preferred in a fixed mount 78a; however, excellent mixing will also occur using blades 70b, 70c or 70d in fixed mounts. Finally, for the best overall performance, it may be best to equip the press with two or more different types of stops such as, for example, stops 70 in 90° adjustable mount 78 for the precise flow-rate control brought about thereby and L-shaped blades 70a in fixed mount 78a for mixing purposes.

What is claimed is:

1. In a screw-type pulp deliquifying press of the type having a rotating spindle carrying a plurality of interrupted helicoid fighting sections that cooperate with said spindle to produce a screw member, a fixed screen member enveloping said screw member shaped to cooperate therewith to define a continuous spiralling pulp passage therebetween of steadily decreasing volume, means for introducing the wet pulp into the large end of said pulp passage, means for collecting the fluids squeezed from the pulp that pass through the screen separately from the pulp emerging from the pulp passage, and drive means connected to the spindle operative to turn the screw member in a direction to move the pulp through to the small volume end of the pulp passage, the improvement which comprises: a plurality of bladed stops attached to the fixed screen and extending radially inward therefrom into the gap left between the interrupted sections of helicoid fighting, said bladed stops each having a substantially greater width than thickness so as to define at least one relatively broad pulp-deflecting surface, said deflecting surface being positioned to receive the pulp mass impinging thereagainst and redirected same toward one of the helicoid fighting sections adjacent thereto

while turning said pulp mass away from the other of said adjacent fighting sections, and said deflecting surface being bent so as to divide same into at least two areas inclined at different angles to said pulp mass impinging thereagainst.

2. The improvement as set forth in claim 1 in which: in the pulp-deflecting surface comprises a twist about an axis extending in the direction of the length thereof.

3. The improvement as set forth in claim 1 in which: the bladed stop is generally L-shaped so as to provide a substantially radially-extending stem portion terminating at the free end thereof in a laterally-extending foot lying closely adjacent the surface of the spindle.

4. The improvement as set forth in claim 2 in which: the blade is mounted for rotation about an axis extending in the direction of its length.

5. The improvement as set forth in claim 4 in which: the blade is twisted approximately one-half turn to produce a single angularly-disposed trough in the pulp-deflecting surface.

6. The improvement as set forth in claim 4 in which: the blade is twisted approximately one full turn to produce a pair of essentially parallel angularly-disposed troughs in the pulp-deflecting surface.

7. The improvement as set forth in claim 4 in which: the blade is twisted approximately three-quarters of a full turn.

8. The improvement as set forth in claim 5 in which: the blade is twisted about its longitudinal centerline, and in which said centerline is substantially coincident with its axis of rotational adjustment.

9. The improvement as set forth in claim 6 in which: the blade is twisted about its longitudinal centerline, and in which said centerline is substantially coincident with its axis of rotational adjustment.

10. The improvement as set forth in claim 7 in which: the blade is twisted about an axis extending along one side edge thereof, and in which said axis is substantially coincident with its axis of rotational adjustment.

References Cited

UNITED STATES PATENTS

3,035,511	5/1962	Hayes	-----	100—117
3,067,672	12/1962	French		

FOREIGN PATENTS

1,160,161	2/1958	France.
269,601	1/1914	Germany.

PETER FELDMAN, Primary Examiner

U.S. Cl. X.R.

100—150